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ABSTRACT

To remain competitive in the international marketplace, the United States will have to recommit to a new era of educational reform. Students must be pushed to reach higher expectations, and the U.S. educational system must find an efficient and centralized mechanism to measure national progress in education reform. This document describes the current trends in the development of indicators designed to measure educational progress. Several specific problems with indicators are targeted, such as: accommodating federal, state, and district information; effectively processing this information; and dealing with the excessive cost of creating and maintaining a national database. All the recommendations for new indicator systems feature some version of an input, process, output model that flows from characteristics of the community and the population served, through characteristics of the school itself, to characteristics of learner outcomes. Student achievement is the primary outcome. This document shows several simple models for indicator systems and discusses how to transform the models into indicators, the indicators into data, and the data into information. The last section addresses national projects to develop indicators, the burdens and benefits these projects have on local schools, and the effects these projects have on the future of education. (30 references) (LAP)

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Current Research on National Systems of Education Indicators: Potential Benefits for School-Based Management

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April 1991

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Introduction

With the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983), the public was warned that what America's young people knew and were able to do was seriously affecting the United States' ability to compete in the international marketplace. American students were finishing in close to last place on international tests of academic achievement. As a consequence, America's economic engine, we were told, was in danger of no longer finishing first. Much of the blame was attributed to the health of America's public schools. Achievement gains made during the 1960s in the wake of Sputnik had been squandered during a subsequent period of minimal expectations and mediocre performance. To remain competitive, the nation would have to recommit to a new era of educational reform driven by higher expectations for what all students ought to learn and do, in fact, achieve.

Since *A Nation at Risk* was published, there has been some extensive work, much of it funded by the National Science Foundation (NSF), to create new and better indicators of the quality of American education to measure the progress of educational reform. According to Shavelson et al. (1989), education indicators are "single or composite statistics that reflect important aspects of the education system." Most of the work on education indicators has dealt directly with problems of monitoring changes in teaching science and mathematics, especially in junior and senior high schools. However, the questions that these systems seem best suited to answer are fairly free of science or mathematics subject matter. Therefore, most of the current work on indicator systems appears to be generalizable to many areas of the school curriculum.¹

This report deals with various aspects of research on education indicators. It begins with the resources created at the federal level and ends with needs that exist in local schools. We will review the results that have been reported from several current projects to develop national indicators of the quality of education. We will first give an overview of current indicator developments and present the reasons why a national system of education indicators is necessary. Second, we will discuss models for indicator systems, and the transformation of: models into indicators, indicators into data, and data into information for policymaking. Finally, we will look at the prospects for developing indicators. In doing so, we will discuss the national prospects to develop indicators, the burdens and benefits for local schools, and the needs of local districts and schools and ways they might be better met by work already being done by indicator projects.

¹These models do not have much relevance to elementary schools. Most of the variables that are contained in them deal with such things as coursework, graduation rates, and teacher specialization in the area in which they teach--variables that pertain only to secondary levels of schooling.

Overview of Current Indicator Developments

Current work on education indicators responds mostly to a need to provide information to federal agency policymakers. States can benefit directly because one of the major concerns in designs for statistical sampling at the national level is eventually to have information that can be compared across states. Therefore, the technology that is evolving to accommodate state-by-state comparisons will undoubtedly generate indicators that are useful to policymakers in the individual states being compared. Some needs of state policymakers will not be met by a national system of education indicators. National designs for statistical sampling currently are not broad enough to allow states to compare districts or schools. Needs for information common to many states are likely to be addressed. However, other needs tied to special concentrations of students or special circumstances created by geography or economics conditions will require information resources to be developed by individual states.

A problem that has not been addressed adequately is the fact that local districts and schools are unlikely to receive many direct benefits from information that will be generated by national systems of education indicators. Developers of national systems have expressed concerns that statistics reported nationally, including state-by-state comparisons, should be understandable to a wide audience of policymakers. But needs of policymakers at local schools and districts have not received much attention. Energy thus far is going into development of a technology that will provide valid information federal policymakers can rely upon. Implications of this work for local districts and schools have yet to be thought through in much detail.

Part of this problem has to do with stakeholding and ownership. Few local schools or districts will have much direct knowledge about national indicators or the significance of how they monitor progress in achieving the nation's goals and objectives. Some local schools and districts will participate in collecting data for national indicator systems, but the data they generate is not likely to be transformed into information they can use. Local schools and districts will not know enough about the design of the indicator system to put the information they are collecting into a context they can interpret. In addition, no one at a higher level is likely to interpret the data for them.

Cost is another part of the problem. Many indicators identified as part of a national system will not be phased into a national system for data collection until ways can be identified to furnish them with data at an acceptable cost. In particular, indicators that require fairly precise accountings of teacher and student engagements in the classroom over an extended period are likely to be put aside for data collection plans. The time that teachers, students, and administrators would have to spend creating and maintaining this part of a national database seems excessive in light of any benefits they would receive. Some of the perceived costs of this kind of data collection could be reduced if ways could be devised to make the data collected by local districts and schools serve their own needs, as well as the needs of technicians who maintain national databases and those of state and national policymaking leaders.

Local districts and schools do have needs for information that will support local policymaking. Some of the characteristics identified with "good" indicators for a national system involve practical considerations that help to keep the information from indicators focused on decisionmaking about school practices. As a result, the systems of national indicators that have been proposed have a grounding in school practice that makes them relevant to the needs of policy and governance at local districts and even school sites.

The policy questions associated with national indicators seem like the kinds of policy questions that managers of local schools and districts also would like to answer. However, the data currently coming from national indicator projects provide very little policy information relevant to local schools. Aggregations of data in national reports tend to focus on the nation as a whole and, to some extent, on comparisons across individual states.

The research going into development of a national system of indicators may, however, be useful to local districts and schools in generating their own data about education indicators. Local districts and local schools do have a growing capacity to satisfy more of their own needs for information to support policy and governance. Many local schools have very good technology and easy-to-use software for data management. The investment needed to provide training and staff development that will greatly enhance the capacity of sites to generate and maintain databases of their own is modest. Work on national indicator systems can help, especially insofar as it identifies modules of indicators that local districts and schools can adopt for their own use. Just as important, work on national systems promises to yield a model and technology, including surveys and sampling designs, that may be adaptable to a level of effort in data collection that local districts and schools could maintain. Characteristics intrinsic to good education indicators--characteristics that define a range of questions that indicators are intended to answer--may lead to syntheses of existing knowledge and findings from new research that are quite relevant to problems associated with policymaking in local districts and schools. Questions about schooling effects addressed by indicators in national systems do appear to be the kinds of questions local districts and schools also need to answer.

Why a National System of Education Indicators Is Needed

The failing grade that *A Nation at Risk* (National Commission on Excellence in Education, 1983) gave to public schools sent a message, heard clearly in the American mainstream, that education needed to be fixed. Another message, heard mainly by federal policymakers, was that the corpus of information about the quality of education to all youth was not very useful. Selden (1988) reports that:

The National Commission on Excellence in Education, which had been charged with developing that report, and the critics and commentators who followed had to struggle to obtain basic facts about the breadth and quality of schooling in the U.S. For example, the Commission on

Excellence had to conduct a special study of transcripts to find out what courses students took in high school. Members of the commission had posited, quite reasonably, that downturns in achievement might be related to fewer course requirements in core subjects, but solid information to substantiate or disprove that proposition was not--and still is not--collected regularly. (p. 492).

The need for better information about national progress in improving education was addressed by the National Science Board Commission on Precollege Education in Mathematics, Science and Technology (1983, p.12) when it recommended that the federal government " ... maintain a national mechanism to measure student achievement and participation that allows national, state, and local evaluation and comparison of educational progress." Since individual states are primarily responsible for operating the nation's system of public schools, most of the data available about the status of education nationwide originates from data collection programs that states maintain. A more centralized mechanism is needed because variables that define the structure of what is observed about the process and outcomes of education are quite different from one state to another. In cases where different states do tend to look at the same variables, the context in which data are collected varies to such an extent that aggregation of information across states is often meaningless. At its most basic level, any effort to measure the health of the nation's education system requires information from all states on what students have achieved. Currently, 47 states have some form of statewide testing program (Education Week, April 10, 1991). However, tests that are used, grades and subjects that are tested, and guidelines for testing some students and not testing others varies widely from state to state.

If achievement data from different states are hard to aggregate in ways that show national progress, they are equally hard to disaggregate in ways that show fair comparisons of one state against another, even when the same test is given in different states. In 1984, the U.S. Department of Education began its publication of *State Education Statistics* (U.S. Department of Education, 1984). This report, better known as the "Wall Chart," ranked states on the average scores from the Scholastic Aptitude Test (SAT) and the American College Testing (ACT) program, tests that are widely used as part of the selection process for admitting students to many of the nation's colleges and universities. These comparisons were widely criticized within the research community because of extreme variations in the student population who took these tests in different states. In fact, publication of these comparisons in the "Wall Chart" has helped to energize efforts to design better indicators of national progress, including indicators of student achievement that will lead to more fair comparisons of schooling outcomes across states.

Indicator Systems

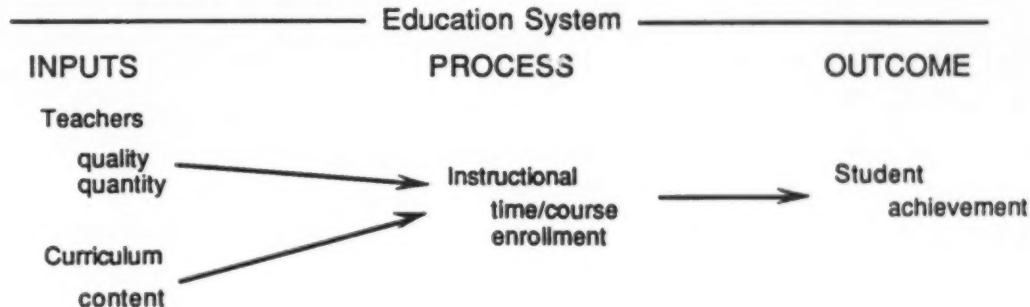
This section of the report discusses models for indicator systems and how to transform the models into indicators, the indicators into data, and the data into useful information.

Models for Indicator Systems

All of the recommendations for new indicator systems feature some version of an input--process--output model that flows from characteristics of the community and the population served, through characteristics of the school itself, to characteristics of learner outcomes. Student achievement is the primary outcome in all of the indicator models we reviewed. However, other variables, such as enrolment in advanced courses and occupational or career choices made after graduation, are considered.

A very simple model of schooling (Figure 1) was used by Raizen and Jones (1985, p.12) to select the National Research Council's (NRC) set of education indicators presented in its first report. The NRC model is particularly significant, partly because it preceded reports of other model building on indicator systems by at least a year. Two additional variables, expenditures and public attitudes, were considered by the NRC committee. They were not included in the selection of indicators, mainly because the committee could find no strong research-based relationships between these variables and schooling outcomes.

Figure 1
National Research Council Model



A later version of the NRC report (Murnane & Raizen, 1988, pp. 143-151) considered "Indicators of Financial and Leadership Support." Two indicators were recommended: level of federal financial support for science and mathematics and mathematics education and commitment of resources by scientific bodies for improvement of mathematics and science education in the schools. However, they were recommended as supplements to another list of seven indicators, which were given highest priority.

Later models were more extensive and included considerably more detail. For example, RAND's basic model of schooling (Shavelson et al., 1987, p. vi) adds details at both ends of the Input--

Process--Output model as shown in Figure 2. Outputs from this model include more than student achievement (although it would very likely be the primary output), and inputs include fiscal resources and student background, along with teacher quality.

Figure 2
Schooling Components Included in the RAND Model

<u>Inputs</u>	<u>Processes</u>	<u>Outputs</u>
•Fiscal and other resources	•School quality	•Achievement
•Teacher quality	•Curriculum quality	•Participation
•Student background	•Teaching quality	•Attitudes and aspirations
	•Instructional quality	

A more recent model (NFES, 1990) reflecting consensus from a broad cross section of education policymakers in state and federal agencies describes an education statistics system that covers four domains and several subdomains as shown below:

- I. Student and community background statistics
- II. Education resource statistics
 - Fiscal resources
 - Human and nonhuman resources
- III. School process statistics
 - Implemented curriculum
 - Teaching quality
 - School environment
- IV. Student outcome statistics
 - Student achievement
 - Student participation and progression
 - Student status after high school
 - Student attitude and aspirations

Other models follow an input--process--output, but include special details that reflect particular concerns of their designers. For example, Hall et al. (1985) singled out *educative difficulties* (pupil's capabilities, motivations, handicaps, English language facility, out-of-school supports, etc.) as one of three background variables because " ... pupils who enroll in some schools enter with

cognitive accomplishments and capabilities, motivations, and out-of-school environments and resources, which make educative efforts easier and less complex than those in other schools." (p. 9). However, Romberg (1987) specifically omitted *instructional time* because it seemed to emphasize the importance of managing instruction in a way that was not entirely consistent with reforms that are being advocated in how mathematics is taught. Moreover, the Wisconsin model converges on a single outcome (a consequent variable) called *further enrollment*, which gives a high priority to information that would show whether or not students are continuing to enroll in more advanced mathematics courses.

The School Reform Assessment (SRA) project (McDonnell et al., 1990) designed a model for identifying coursework indicators that would fit within a larger input--process--outcome model of the schooling process. One objective was to probe the dimensions of what it means to measure course content that goes beyond a title or even a syllabus. Another objective was to gauge the feasibility of actually obtaining in-depth information about coursework to determine the quality of information that might be produced using relatively low-cost methods such as teacher surveys. The project's model for student coursework included four basic elements (p. vi):

- Topic Coverage
- Instructional Strategies
- Curricular Objectives (e.g., emphasis on concepts and processes in comparison to basic skills)
- Teacher Qualifications

A larger model of the schooling process was not specified as such, but indicators identified by the project could easily fit within several of the models already reviewed (e.g., Raizen & Jones, 1986; Shavelson et al., 1987).

Porter (1991) outlines a strategy for obtaining national data on coursework content and other indicators of school processes following what is essentially the RAND model identified by Shavelson et al. (1988). His rationale is that process indicators are needed to describe opportunities that schools provide for students to learn. The opportunities, he maintains, are the most direct results of school policy decisions and are the mediators of indirect outcomes representing what students actually do learn. Indicators of school processes also are important in monitoring substantive efforts to reform schools and in helping to explain student output, such as achievements in mathematics or science. He recommends initial concentration of efforts to collect school process data on English and mathematics at grades K-5, 6-8, and 9-12. To control costs, Porter recommends the use of teacher questionnaires about topics that students have covered. More direct methods for obtaining data, such as classroom observations or teacher interviews, are more expensive and more appropriate for research studies rather than an ongoing collection of statistics for education indicators.

The Organization for Economic Cooperation and Development (OECD) is developing an international model for indicators that generate comparable educational statistics across nations (Bottani, 1991). OECD exists to foster economic growth among its 24 member countries. Education indicators are needed to go along with other better-established indicators in economics, environment, health, science, and technology used by OECD in analyzing trends and making projections about economic health and future growth. OECD has created a Center for Educational Research and Innovation that has been working since November 1987 to assess interest across nations in having education indicators and to determine the feasibility of actually generating education usable statistics. The OECD model currently covers six domains:

- Student Achievement
- Education and Labor Market Participation
- Features of Schools and School Systems
- Attitudes and Expectations
- Student Flows
- Costs and Resources

Three domains--costs and resources, features of schools and school systems, and student achievement--are included in the input-process-outcome models of national indicator systems being developed for the United States. Other domains are more unique to the interests of OECD in conducting comparisons across the nation. They also seem to reflect a preoccupation by model builders with the statistics that are most compatible with the uniqueness of politics, culture, and technology across nations. Education and labor market participation includes indicators, such as "training schemes for 15-24-year-olds looking for a job" and "relative earnings of employed adults by educational attainment." Attitudes and expectations would consist of indicators dealing with data from national surveys of teachers, students, parents, and public opinion polls that dealt with such things as curriculum, equality, spending for education, and teacher expectations. Student flows is a domain that deals exclusively with the progression of students through various education levels roughly comparable across nations.

Transforming Models into Indicators

Models of schooling are the platforms for generating indicators that will provide policymakers at various levels with a picture of what is happening and whether things are getting better or worse. Some reports on the design of indicators have stated explicit criteria for going from model to indicator (Shavelson et al., 1987; Blank & Dalkilic, 1990; McDonnell et al., 1990). Other reports allude to general principles followed in identifying indicators (Raizen & Jones, 1985; Blank, 1986), but do not

identify criteria as a distinct step in the process that was followed in indicator design and development².

One of the most important qualities of an education indicator is that its definition needs to reflect the imprecision of the context in which it will be interpreted and used. Oakes (1986) has described an educational indicator as a statistic that reveals something about the performance or health of the educational system. "Obviously, indicators do not tell everything about a system. Instead, they provide an 'at a glance' indication of current conditions and may even augur future prospects." (p.1). Indicators are appropriate for monitoring over time the performance of complex systems that include many interrelated components. Indicators are statistics, but not all statistics are indicators. For a statistic or measure to be used as an indicator, it must have a reference point so that a judgment can be made on whether the condition being described is getting better or worse (Murnane & Raizen, 1988, p. 28).

Indicators describe conditions that reflect linkages among different elements of an educational system, but they do not allow us to isolate causes. They are particularly useful in social situations where changes can be observed with some precision and regularity, but the control of situations needed to infer causality is not feasible. The rationale for Wisconsin's mathematics monitoring center was developed around what Romberg (1987) and Romberg and Smith (1987) describe as a causal model. However, Shavelson, Oakes, and Carey (1987) took issue with the logic of obtaining causal inferences from a monitoring system intended to reflect the broad range of complexities present in the schooling process:

Causal claims from nonexperimental research must, of necessity, rest on strong theoretical grounds to rule out plausible counterinterpretations to the proposed causal interpretation. A strong theory, one that is logically consistent and empirically justifiable, specifies the components of a causal system and their causal ordering, as Romberg points out. In the absence of strong theory, we run the risk of inaccurately specifying the causal model by omitting components that are required to rule out counterinterpretations or by incorrectly specifying the existing (and/or direction of) causality. The consequence of a weak theory is that we may erroneously infer causal relations where they do not exist or where the causal flow is in the opposite direction ... a national monitoring system, of necessity must cast such a wide net to reflect the 'health' of mathematics education that it cannot possibly include in its specification the level of detail that would permit causal inferences. (p. 96)

²Hall et al. (1985) did not identify specific indicators, only a model for developing a system of indicators. Their view was that specific data items (indicators) should be identified by the Center for Statistics and its constituencies, "...if the system is to effectively meet the needs of data users" (p. 4). National Forum on Education Statistics (1990) identified principles that followed in setting up a new data system, but they had more to do with how data should be reported than with selection of indicators.

After reviewing the literature on the social indicator movement that developed in this country during the late 1960s and early 1970s, Shavelson et al. (1988) concluded that indicators cannot do some things:

- Set goals and priorities. Educational goals and priorities are established by the public through its elected representatives. The information generated by an indicator system can inform those objectives, but it is just one factor among many in shaping decisions about policy preferences and priorities.
- Evaluate programs. Social indicators cannot substitute for a well-designed, in-depth social program evaluation. They do not provide the level of necessary rigor or detail.
- Develop a balance sheet. Social indicators lack the common referent available to economic indicators ... education cannot put each of its constructs on a common dollar metric. (p. 8)

An indicator should be able to do many things to inform policymaking. In design of an indicator system, they are the criteria by which indicators should be selected. The RAND project used this model of schooling³ and developed an extensive set of criteria to generate actual indicators (Shavelson et al., 1987):

- Provide information that *describes central features of the educational system*, such as teachers' work load or curriculum offerings.
- Provide information about *current or potential problems*, such as changing demographics.
- Describe educational conditions of particular concern to policymakers and *amenable to change by policy decisions*.
- *Measure observed behavior*, rather than perceptions.
- *Provide analytical links among important components*.
- Generate data from measures generally accepted as *valid and reliable*.
- Provide information that can be *readily understood by a broad audience*.
- *Be feasible* in terms of timeliness, cost, and expertise. Indicator data need to be produced within a time frame that is compatible with policymakers' decision cycles and within given cost constraints; they also should be collectable, analyzable, and reportable within current levels of expertise.

Indicators should measure enduring features of the system, such as the number of mathematics courses required for high school graduation, rather than specific policies such as whether computer

³The RAND project considered several alternatives for developing a monitoring system depending on the extent to which data that were already collected at the state and federal levels would be used.

math is required. They also should measure ubiquitous features of schooling--dimensions that can be found in some form throughout the system (Oakes, 1986, p. 2).

Shavelson et al. (1987) make a distinction between an indicator and an *indicator system*. The latter, they maintain, is a set of interrelated indicators based on a conceptual model (p. 9). Interrelated indicators are needed to match the underlying complexity of interactions among student characteristics, teacher qualifications, conditions of schooling, and other factors. Those complex interactions underlie major changes observed in what students opt to do, such as enroll in higher level mathematics courses, and how they perform.

Raizen and Jones (1985) described a simple approach to developing the NRC model in which the selection of indicators would be "guided by relevance to policy" (p. 29). The SRA project (McDonnell et al., 1990), in probing the depths of high school coursework, identified four specific criteria that this kind of indicator of curriculum processes must satisfy:

- It must be linked to a larger model of the schooling process.
- It must differentiate among tracks or levels of the curriculum.
- It must distinguish between the curriculum as it is intended by designers and policymakers and as it is actually implemented in schools and classrooms.
- It must measure, to the extent possible, the depth of the curriculum, as well as its breadth.

The State Education Assessment Center, in developing the Council of Chief State School Officers (CCSSO) model, first identified a set of "ideal" indicators (Blank, 1986) in which selection would be based on a synthesis of results from work on the NRC and RAND models, the Wisconsin monitoring system (Romberg, 1987), and other projects already under way. From that set, Blank and Dalkilic (1990) reported that a list of "priority" indicators were selected based on three criteria: (a) importance and utility of an indicator at national and state levels; (b) technical quality of data that can be obtained; and (c) feasibility of obtaining required data (p. 7).

The OECD model of indicators (Bottani, 1991) features a template for standardizing descriptions of individual indicators across the model's six domains⁴. The various descriptors in the template include:

Generalities

- name of indicator
- definition
- rationale and relevance
- place in organizing frame (domain)

⁴ The template for standardized description of indicators is part of a handbook of international indicators that OECD plans to develop in 1991-92.

Statistics

- basic data
- breakdowns (e.g., by demographic variables)
- calculation template (formulas)

Availability

- technical validity (how likely is it that statistics will be comparable across nations)
- feasibility (difficulties that may be encountered in obtaining data because of differences in the way education systems are organized in different nations)
- political acceptability (the value that different countries are likely to place on an indicator)

Feasibility and cost effectiveness are concerns that have shaped most of the current work on education indicators. Another concern is the problem of integrating federal and state needs for indicator data, partly to speed up the process of getting indicator systems operating and partly to reduce burdens on states and local schools. The primary purpose of the UCLA/CSE study (Burstein et al., 1985) was to determine the feasibility of fashioning a national system of educational indicators from existing state-level data on student achievement. One of five alternatives for developing a national-indicator system considered in the RAND project (Shavelson et al., 1987) was a low-cost "status quo" approach where only *existing* state and federal data would be retrofitted to a national model. The CCSSO's State Education Assessment Center, which sponsored the State Science and Mathematics Project (Blank & Dalkilic, 1990), was established in 1985 with a continuing responsibility to coordinate the development, analysis, and use of state-level data⁵. Most recently, the NFES (1990) has been established as the principal federal mechanism to satisfy a congressional mandate that state and federal agencies cooperate in reshaping the nation's elementary and secondary data system.

Actual lists of indicators vary in detail and length from seven "key" indicators and six "supplementary" indicators in the NRC system (Murnane & Raizen, 1987, pp. 2-4), shown in Table 1, to almost 40 indicators in RAND's model (Shavelson et al., 1987, p.37) of a "piggyback"⁶ indicator system as shown in Figure 3.

⁵In fact, CCSSO's 1990 report on state indicators is represented as a "first ever" compilation of state-by-state data that have been integrated to fit a single model for looking at the condition of science and mathematics education in schools nationwide (p. 2).

⁶The "piggyback" system is one that expands current data collection efforts, most of them by the National Assessment of Educational Progress. Other options considered in the RAND project would involve the National Science Foundation in collection of data independent of what is being done now by other agencies.

Table 1
Indicators in NRC System

Primary Indicators	Supplementary Indicators
Extent of student learning in mathematics and science Extent of scientific and mathematical literacy of adults	Amount of time spent on science and mathematics homework Teacher preparation-college courses in mathematics and science, majors and minors, advanced degrees
Enrollment data for mathematics and science courses taken by students in high school and the time spent on the study of science and mathematics in elementary and middle/junior high schools	Teachers' use of time outside the classroom spent on professional activities related to the teaching of mathematics and science
Nature of student activities during science and mathematics instruction Extent of teachers' knowledge in the subject matter they are expected to teach	Materials, facilities, and supplies available and used by teachers in mathematics and science instruction Level of federal financial support for science and mathematics education
Salaries paid to college graduates, with particular subject-matter specialties, who choose to enter various occupations	Commitment of resources by scientific bodies for the improvement of mathematics and science education in the schools
Quality of the curriculum content in state guidelines, textbooks and associated materials, tests, and actual classroom instruction in science and mathematics through matching to exemplary curriculum frameworks along four dimensions: breadth and depth of treatment and scientific and pedagogic soundness	

The NFES (1990) did not identify indicators, as such. Instead, broad recommendations were made under each category of its indicator model, described earlier, for various kinds of data collection and reporting that should be undertaken by different federal agencies. Some recommendations deal with improved use of data already known to exist at the state or federal level. Other recommendations involve disaggregations of existing data by such variables as sex, ethnic group, language status, community wealth, and family income. The NFES also recommends collection of some new data not available now.

Figure 3
Indicators in RAND "Piggyback" Indicator System

<u>Resources</u> Per pupil expenditures Percent of personal income expended on education Beginning teacher salary Average teacher salary Class size/teaching load Computer use and laboratory facilities Resource adequacy Computers available at the school Experienced teachers' salaries	<u>School Characteristics</u> Course offerings Course-taking requirements Teacher planning time Dropout rates Student enrollments	<u>Classroom Characteristics</u> •Curriculum Textbook and materials use Coverage of core topics •Instruction Homework Student use of labs and computers Teaching methods Access to labs and computers Assessment	<u>Student Achievement</u> Mathematics Science of all students college-bound seniors prospective science/math majors
<u>Teacher Characteristics</u> Descriptors Experience Comfort with subject matter Recency of education enrichment			<u>Student Participation</u> Extracurricular activities Current math/science course-taking
<u>Student Characteristics</u> Race/ethnicity Gender Courses taken Grades Socioeconomic status			<u>Student Attitudes</u> Interest, liking, etc. Social usefulness Career relevance Intended college major Conceptions of math/science

The CCSSO project (Blank & Dalkilic, 1990) identified 11 specific indicators, along with anticipated data sources as shown in Figure 4:

Figure 4
CCSSO Priority Indicators

Student Outcomes

Student achievement (NAEP)
Student attitudes/intentions (NAEP)

Instructional Time/Participation

Grades 7-12 course enrollment (state data collected by CCSSO)
Elementary minutes per week (NCES/Staffing Survey [SASS])

Curriculum Content

Students' opportunity to learn (data not available)

School Conditions

Class size (SASS or CCSSO state data)
Number of course preparations per teacher (SASS or CCSSO state data)
Course offerings per school (SASS or CCSSO state data)

Teacher Quality

Courses/credits in science/math (SASS)
Teaching assignments by certification in field/subject (CCSSO state data)

Equity

Gender and race/ethnicity by student or teacher indicator (CCSSO state data)

During 1989-90, the CCSSO project pieced⁷ together state-level data on all indicators except *student outcomes*⁸, *curriculum content*, and *number of course preparations per teacher*. From its own surveys, the project obtained data related to one or more indicators from 46 states.

Transforming Indicators into Data

A great deal of mediating activity takes place before one of the indicators that we've seen identified as an element of a national indicator system becomes a statistic, or, as is more often the case, becomes an integrated set of several statistics. The indicators are really constructs that tend to evoke a "common" sense that something is being measured, and that more of it or less of it will tell us there has been a change in the quality of education. A higher per pupil expenditure is sensed as an increase in public support for schools, if not a direct increase in school quality. Higher dropout rates are sensed as a decrease in school quality or effectiveness. Indicators are rarely something that someone can observe directly.

⁷From its own surveys, the CCSSO project has obtained data related to one or more indicators from forty-six states. In the early phases of this project, the quality of data coming from individual states is hard to verify. Therefore, comparisons across states using the CCSSO model are understandably tentative.

⁸State-by-state data will be available from the National Assessment of Educational Progress (NAEP) in June 1991, when first state-level results on mathematics at grade 8 will be released.

To generate data, most all of the "indicators" must be transformed into specific questions or "pointers" that can be answered or quantified as part of an instrument or some other source for data collection. Sometimes, the source is a file from a district, county, or state office where certain kinds of databases, such as certificates held by teachers, or textbooks ordered for instruction, are maintained from year to year. In generating data for an indicator, numbers are taken from the file and recorded somewhere else, according to some protocol that has been worked out ahead of time, usually with a fair amount of precision. More often, the data collection involves a survey, a form, a log, or a test that is completed by students, teachers, administrators, or clerks within an individual school or by an external observer who goes to a school site.

Few indicators are transformed into data in isolation from other indicators. More often, the questions that define a particular indicator are combined in a survey or form with questions that define other indicators. A sampling plan is devised, and data for several different indicators are gathered simultaneously.

The technology for transforming indicators into data can be expensive, especially if external observers must be hired to do data collection at school sites. Often, dollar costs are kept within acceptable bounds by shifting some of the burden of data collection to local districts and school sites. However, the added responsibilities placed on school personnel to gather data for someone else's project often increases resistance in local districts and school sites to perform the necessary services. Sometimes, schools, districts, and even states have no choice. Provision of indicator data is required by legislation or it may be a contingency for receiving federal funds. Nevertheless, the real dollar costs associated with the kind of extensive data collection needed to support a national system of education indicators appears to stimulate a search for efficiency of effort.

Panels engaged in designs for a national system of education indicators have all recommended extensive use of existing sources of data rather than developing new data collection programs. Shavelson et al. (1987) considered an all new technology for data collection as one of several alternatives, but recommended a "piggyback" technology that combined some new data collection with the use of data from national surveys and other existing sources. Murnane and Raizen (1988) and the NFES (1990) also recommended extensive use of existing data, but were quite explicit about new data that would eventually be needed.

The first priority in developing national indicators is to provide a nationwide picture of education. It is followed closely by a desire to be able to make state-by-state comparisons in ways that are technically valid and meaningful to policymakers at various levels. The NRC model (Murnane & Raizen, 1988), RAND model (Shavelson et al., 1987), CCSSO model (Blank & Dalkilic, 1990), and the work of the NFES (1990) all reflect deliberations on the need to do state-by-state comparisons. In the first phases of data collection for a system of national indicators, the probable sources of existing data are mostly nationwide education surveys already being conducted by the National Center for Education Statistics, including:

- National Educational Longitudinal Survey (NELS) (some states)
- National Assessment of Educational Progress (NAEP) (37 states in 1991)
- Common Core of Data Surveys (CCD) (all states)
- Schools and Staffing Survey (SASS) (all states)

In one way or another, these surveys would be modified and expanded to allow for new linkages in information called for in the input-process-output models that various indicators panels have produced.

Other possible data sources listed by the NFES (1990) include: additional NCES data collections, such as the International Assessment of Educational Progress; data collections from other agencies of the U.S. Department of Education, such as the Office of Civil Rights and the Office of Special Education and Rehabilitative Services; and data collections from the U.S. Census Bureau and other federal agencies outside the U.S. Department of Education.

Data collections that exist in individual states also are considered as possible sources of data, but only the CCSSO project (Blank & Dalkilic, 1990) seems to have gone very far in developing a methodology for obtaining these data in ways that will allow them to be combined or compared across states. Developers of models for national indicator systems have been quite cautious in recommending the use of data collected by individual states. Different states collect different data under differing circumstances that make any aggregation of data across states very difficult.

Burstein et al. (1985) found that even scores on achievement tests are difficult to combine in meaningful ways across states. While they considered the possibility of statistically equating a limited amount of achievement data coming from statewide testing programs, all other projects we reviewed tended to see the NAEP as the primary source of data on student performance. Until recently, NAEP designs for obtaining a nationwide sample on student achievement data allowed only for disaggregation of data down as far as U.S. geographic regions. Comparison of data across states will be possible beginning in 1991 with NAEP's report of nationwide performance in mathematics at grade 8. Even the CCSSO's State Education Assessment Center (Blank & Dalkilic, 1990) plans to use NAEP in its assembly of data coming from individual states into a single set of indicators.

Generation of some indicator data already is taking place. Many of the indicators that have been included in models of national systems are associated with national surveys conducted by the Department of Education and other federal agencies. However, operation of anything close to a complete system of national indicators envisioned by Hall (1985) or Shavelson et al. (1988) still is a long way off. CCSSO's State Science and Math Indicators project (Blank & Dalkilic, 1990) has made some progress in operating a complete system, with its bottom-up approach to assembling state data to fit a national framework. Some indicators in the CCSSO system use data from NCES national surveys and cover all 50 states and the District of Columbia. However, the parts of the CCSSO national

picture that require information from states themselves are missing because many states do not yet participate. Moreover, some indicators in the CCSSO system require data that don't yet exist, and some of the data that do exist are questionable when data from different states are combined or compared.

Top-down models for national indicators also have problems. Currently, there are many good data collection programs, but no coordinated system yet for linking resources, processes, and outcomes in the comprehensive way that models for a national system call for. Outcomes measures are limited. All recommendations from all reports we reviewed included the use of NAEP data for at least some outcome indicators that deal with achievement. But NAEP is limited, both in the number of grade levels that it assesses (grades 4, 8, and 12) and the ability of its sampling design, until recently, to disaggregate information by state. By 1992, NAEP plans to have state-by-state data in mathematics for grades 4 and 8. These data will allow for some direct comparisons of states, but, given the current two-year cycle for assessment in mathematics, analysis of time series across states will not be possible in this decade.

Virtually all reports that we reviewed addressed the need for outcome measures that involve open-ended work or actual performance by students, rather than students' responses to multiple-choice test items. These alternative forms of assessment should be a supplement to and, in some cases, a replacement for current ways of testing that focus on discrete skills and limit student responses to contexts that are quite confined. The technology for this kind of assessment is limited except, perhaps, for writing. Moreover, the technology requires a consensus for what students need to know that has yet to be established within content areas.

Process indicators are constrained by large holes in what we are able to observe with adequate efficiency. Models for national systems call for indicators of opportunity to learn that go well beyond titles of high school courses. McDonnell et al. (1990) have completed a feasibility study on analyzing coursework by time spent on different topics. However, the effort needed to include this kind of analysis as a meaningful part of an ongoing data collection program is daunting. The methodology that was used in the study was designed to fit the dimensions of a high school curriculum. Adapting it to fit the curriculum and instruction of elementary schools is a difficult task. In the past, this kind of analysis was carried out by looking at textbooks, under the assumption that teachers taught what textbooks presented. That assumption is far less likely to be valid now than it was in the 1970s and early 1980s. Even if it were valid, indicators that tell us how well teachers follow textbooks are not consistent with current standards for how mathematics should be taught and learned. Porter (1991) has proposed a first step in generating indicators of curriculum processes where a sample of teachers nationwide would complete written questionnaires dealing with topics covered and related variables in English and mathematics. Classroom observations or even the maintenance of day-to-day logs by teachers would be more sensitive. But Porter thinks they are too ambitious for the ongoing process of generating indicators and more appropriate for a research study.

Transforming Data into Information for Policymaking

For data to have usefulness and power, they must be packaged as information. The transformation of data into information requires some consideration about an audience. The same data can be packaged in different ways to satisfy the needs and interests of different audiences and the ways in which data are likely to be used. The primary audience for information from national indicator systems is made up of federal policymakers.

Meeting the needs of a national audience for indicator information is clearly a priority in all of the major projects we reviewed (Murnane & Raizen, 1988; Shavelson et al., 1987; Blank & Dalkilic, 1990; NFES, 1990; Burstein, 1991; National Education Goals Panel, 1991). The importance of considering indicator development in the context of information and audiences was a primary concern expressed by Murnane and Raizen (1988) and Shavelson et al. (1987). In both cases, indicators that were selected for national models ostensibly fit some assumptions about policymakers as users of information. Special considerations were given, for example, to inclusion of indicators on race, sex, and ethnicity in national models, so that sampling designs for data collection could allow for disaggregation of outcomes, such as student achievement data by characteristics of students. These features in the model were thought to be particularly important to concerns about equity among federal policymakers. Shavelson et al. (1987) also expressed concerns that developers of national systems for education indicators pay particular attention to policymakers as the primary audience in order to avoid problems that had a negative impact on the social indicators movement in the 1960s. Researchers became the primary users of social indicator data during that period, and the information became shaped in ways that lessened its usefulness for federal policymakers.

National reports on indicators are being planned or recommended in several projects. The CCSSO (Blank & Dalkilic, 1990) has already published its first report primarily as a set of comparisons across states for individual indicators. The National Education Goals Panel (1991) will publish its first national report card of education indicators in September 1991. The Special Study Panel on Education Indicators (Burstein, 1991) is recommending that NCES publish reports in each of six areas on a regular schedule. National surveys, such as NELs and SASS, will presumably continue to publish national reports for primarily a national audience, although many reports will contain data for particular states as part of state-by-state comparisons. NAEP does have a program for providing reports about specific states if the states fund the expansion of NAEP data collection and processing necessary to generate a state report.

Usefulness of national indicators for state policymakers will likely be limited. States are most likely to see information about themselves in published reports that show state-by-state comparisons. Profiles of indicator data for individual states does not seem among current reports that federal projects will provide. However, states may be able to generate their own profiles from databases created by

national indicator projects. Shavelson et al. (1987) recommended that national indicator systems include sampling designs large enough to allow for state level disaggregation of outcome data by input and process variables, such as characteristics of students and qualifications of teachers. However, national data collections programs in education, except for NAEP, do not currently appear to have this kind of capacity.

McDonnell (1989, pp. 256-257) considered and rejected the possibility of using reports from a national indicator system to somehow increase the accountability of states making certain kinds of improvements over time. She reports that policymakers who were interviewed as part of the RAND indicator project (Shavelson et al., 1987) were unanimous in their opinions that a national indicator system should not be used to heighten accountability. Moreover, the level of detail that would be required to use a national indicator system to establish linkages between specific policies and outcomes in an individual state requires a huge program for data collection that carries unreasonable costs. Reports to individual states, if they are expected to affect state policy, would need to be tailored to the special needs of governors, legislators, or chief state school officers and the levels of state education policy each group represents. Reports also might need to be tailored to meet unique conditions that define the context for education in individual states, and timed to coordinate with different cycles for decisionmaking in different states.

Prospects for Developing Indicators

This section of the report discusses the national projects to develop indicators, the burdens and benefits for local schools, and what the future may be like.

National Projects to Develop Education Indicators

Since 1983, there has been a great deal of work in designing a national system of education indicators. Most major projects or working groups have dealt in one way or another with creation of some kind of model that captures the most salient policy-relevant features of schooling and associated outcomes. A large part of the early work has been funded by the NSF to create indicator systems for science and mathematics.

This early work includes support for the Committee on Indicators of Precollege Science and Mathematics Education, sponsored by the National Research Council (Raizen & Jones, 1985; Murnane & Raizen, 1988), which produced one of the earlier models that attempts to link school inputs, processes, and outcomes; RAND Corporation's indicator project that weighs costs and benefits for alternative systems for actually maintaining a system of education indicators (Shavelson, McDonnell, Oakes, Carey, & Picus, 1987); the State Science and Math Indicators Project, sponsored by the State Education Assessment Center and created by the Council of Chief State School Officers (Blank, 1986;

Blank & Dalkilic, 1990), which has recently produced the first set of state-by-state data tied to an indicator system; and the School Mathematics Monitoring Center⁹ at the University of Wisconsin-Madison (Romberg & Stewart, 1987), which proposed to track nationwide progress in implementing new policy actions designed to change the teaching and learning of mathematics in U.S. schools. While these projects and study groups have addressed the need for indicator systems in science and mathematics, all have produced models for indicator systems that are adaptable to other areas of the school curriculum, especially in secondary schools.

Other work also has attended to designs for education indicator systems and each has produced a model of different aspects of the schooling process where better information would lead to better policy. One involved a "10-year plan" for data collection commissioned by the U.S. Department of Education as part of a redesign of its National Center for Education Statistics' elementary and secondary data collection program (Hall, Jaeger, Kearney, & Wiley, 1985).

The National Education Statistics Agenda Committee (NESAC) of the National Forum on Education Statistics, is carrying out a mandate to engage in cooperative, consensus building activities that will lead to an agenda for improving the nation's elementary and secondary education statistics system. The National Forum includes more than 100 representatives from state and federal education agencies and national education organizations (National Forum on Education Statistics (NFES), 1990)¹⁰.

The National Education Goals Panel is monitoring goals for the year 2000 that were agreed upon by President George Bush and the National Governors' Association (*Education Week*, March 7, 1990). The agreement on 6 goals and 21 objectives is the result of commitments made by Bush and the nation's governors at an education summit convened by the Bush administration in the fall of 1989 in Charlottesville, VA. Mechanisms for tracking the progress of the nation and the 50 states in meeting these goals are being developed by a National Education Goals Panel that includes representatives from the National Governors' Association, the Bush Administration, and majority and minority leaders of the House and Senate. The panel has pledged to issue an annual report card on the implementation of National Education Goals, beginning in September 1991. During the past year, six resource groups have convened to consider each of the 6 education goals and to recommend the kinds of indicators that should be included in the Panel's first report (National Education Goals Panel, 1991). For the most part, recommendations regarding the September 1991 report have dealt with national sources of education statistics that already exist, such as the National Health Interview Survey, administered by the National Center of Health Statistics, NAEP, and the National Educational Longitudinal Study (NELS), sponsored by the National Center for Education Statistics (NCES).

⁹This project is no longer funded by the National Science Foundation.

¹⁰The National Forum, established in 1989, is the principal mechanism for implementing goals of the National Cooperative Education Statistics System, created by the Hawkins-Stafford Education Amendments of 1988. This system provides a legislative mandate and structure for a federal-state partnership that collects and reports elementary and secondary education statistics under the auspices of the Center for Statistics of the U.S. Department of Education.

These resource groups also have proposed sweeping new efforts, including a national data system that would collect data for each student beginning sometime prior to entry into kindergarten, and a system of national examinations that would measure performances of all students nationwide against national standards. Overall, these resource groups have recommended more than 50 indicators and the corresponding sources of data that either exist now or need to be created in order to generate them. Current sources for these indicators are mainly limited to nationwide data and will not allow state-by-state tabulations until their sampling designs are expanded.

A similar project involves work by a Congressionally mandated Special Study Panel on Educational Indicators, which is charged with advising the commissioner of the NCES (Burstein, 1991). The project currently is working on developing sets of indicators tied to six "enduring" issues:

- Knowledge, skills, attitudes and dispositions for well-educated citizens in a 21st-century democratic society
- Quality of schools
- Readiness for school
- Societal support for education
- Educational contributions to economic productivity
- Equity in opportunities, experiences, and results for children at risk of school and societal failure

Panel members will propose that NCES publish a series of indicator reports on a regular schedule. Each report would include current information on key indicators for one of the six issues.

Related efforts include the School Reform Assessment Project, which developed strategies for monitoring the content and quality of coursework taken by high school students (McDonnell, Burstein, Ormseth, Caterall, & Moody, 1990), and work of the Office of Educational Research and Improvement (OERI) State Accountability Group (1988), in which recommendations were made for improving indicator systems for establishing accountability within states. In addition, UCLA's Center for the Study of Evaluation conducted a study in 1984 and 1985 of the status of testing systems in individual states and the feasibility of combining information from existing state tests for purposes of comparing student performance across states (Burstein, Baker, Aschbacher, & Keesling, 1985). The major purpose of the development work on indicator systems since 1983 has been to provide federal and state policymakers with a more complete picture of the effectiveness of America's schools. However, as Burstein (1988) describes in his brief history of education indicators in the 1980's, events have been driven by a " ... strong pressure for improvement, a need for means to assess the impact of educational reforms, and consequent political maneuvering to determine who sets the standards and who measures progress toward them." (p. 78).

Burdens and Benefits for Local Schools

At a time when local schools are assuming more responsibility for site-based management, they are not likely to find much information from national indicator systems that will pertain directly to their own policymaking. Hall et al. (1985), for example, were concerned about the impact of indicator systems on local districts and schools, but the concern was more for the effort that would be required from teachers and administrators in order to collect data than for benefits from national indicators that might be realized by local schools and districts. Extensive sampling designs would be required to allow for disaggregation at the level of local districts or schools of outcome measures, such as *achievement*, and context variables, such as *homework assigned*. McDonnell (1989) maintains that the benefits to local districts would be limited to information that links outcomes and processes for types of districts (p. 254).

Local school sites are not likely to see their own image reflected in any snapshot of education that a system of national indicators is likely to provide--not in this decade, at least. The hierarchy of reports that will get established during the 1990s will include various kinds of national profiles, along with comparisons among individual states. At the very best, *types* of districts within states might be described by data coming from national indicators. An individual district might be able to identify with another district that serves communities with similar background characteristics and financial resources. Any further disaggregation of data to types of schools within districts seems improbable, at least in the foreseeable future. In addition, further disaggregation is not a prospect that individual schools are likely to wait for as they operate their own programs and make more of the policy that affects what they do and what they may be able to accomplish.

Many local school sites will participate in the generation of national indicators because the sampling designs to be used for data collection call for the classroom or section of a course--a unit of instruction defined by a set of students and their teacher--to be the unit of observation. Hall et al. (1985), for example, recommend that the actual generation of indicators begin with a collection of what they call micro records, where information about individual pupils can be linked to information about individual teachers. In linked form, the new units of information from these individual records will be aggregated to higher levels that include school, district, and state. The burden on any single teacher or group of students will be slight. There are many teachers and groups of students across the country to sample from, and designs for a nationwide sampling of data tend to focus on getting the most information from the smallest interventions into the mainstream of school activities.

The collection of data for indicators may disrupt the school life of some individual students and their teachers, but it does not tend to invade the collective lives of a school or district. An acceptable balance at the school site is struck between the burden of data collection and the benefit of information received. No direct benefits are received, but the burden of data collection is very small. Individual teachers are willing to participate as long as the preparation that's needed to provide data is quite small

and the information that's required to complete surveys or forms can mostly be recalled or reasoned and not researched.

The burden at the school site of generating indicator data will escalate seriously when indicators of what teachers teach and students actually have an opportunity to learn are seriously pursued. Sustainable probes into such things as opportunity to learn have mostly been put off, partly because of cost and complexity of data collection. Teachers' impressions of topics they have covered (or usually cover) during the year and relative emphasis they have given to each topic may not be accurate. They also may not provide the kinds of detail needed by national analysts to get a good picture of what all students have had an opportunity to learn. Therefore, some new kinds of record keeping or forms maintenance will be required from teachers and local administrators during the year if indicators of what is taught are to provide true images of school curriculum and instruction. Other kinds of record keeping such as those used in the School Reform Assessment project (McDonnell et al., 1990) will be necessary to generate indicators for other dimensions of school context. Those include the use of "hands on" methods for teaching science and mathematics, or the amount of real time and effort going into problem solving and critical thinking.

As long as design and development of education indicators remains a top-down process flowing from the federal government to individual states, the cost of generating many indicators needed to fill out a national picture of what is being accomplished may seem unreasonable. Data that teachers and administrators will provide to maintain a national indicator system will become information intended mainly for an audience of policymakers at federal and perhaps state levels of governance. Benefits to teachers and administrators are small if there is any sense at all of benefits at the local level. Local teachers and administrators are likely to have little stake in the process that has been designed to generate indicator data, even though indicators themselves have as much relevance to planning and policymaking at the school site as they do at national levels.

Ownership of information is linked to ownership of process and to the proximity to decisionmaking to affect the choice of values that indicators embody. Ownership of process gets established at the level of effort where problems in leadership have been well articulated and well heard, motivation to seek a solution has reached a critical mass, and intellectual capital has been invested in designing forms, surveys, assessments, and so on that will actually generate information that is thought to be needed. Teachers and administrators may help to collect indicator data. However, they have little sense of ownership and probably no real understanding of the strategies that transform broad constructs (e.g., class size and teacher qualifications) into data that represent gains or losses in school quality. Moreover, there is little sense of how policies made by teachers and administrators in managing education at school sites affect values that indicators may take in the future.

Costs are assessed against effort, even at the federal level of ownership, but they are more likely to be sensed as an expense for overhead rather than an outlay for direct effort. When the effort to generate information for a system of indicators is local, not federal, teachers and administrators assess

the cost of gathering it against its utility. If costs are perceived as too high, local teachers and administrators are more likely to show resistance to participate in data collection. Indicators that require more effort from teachers and site administrators are likely to be sensed by those who design data collection plans as having higher costs, even if no real dollar amounts are charged against anybody's budget.

Perceived costs for some hard-to-get-at indicators may be mediated by re-establishing ownership. In this case, ownership of process doesn't need to be shifted so much as it needs to be broadened directly to local sites, rather than state or district sites. Paying local sites to generate information about context and process indicators doesn't establish ownership of process. It isn't sufficient to assure that information will be of high quality, and it may not be necessary. Addressing the need of leaders at local sites--either strong principals at traditionally managed school sites or management teams at sites where decisionmaking is shared--is a better bet.

School sites do engage in policymaking. Decisions about long-term provision of school services are made at national, state, district, and school site levels. Differences among them relate more to scale than to spheres of exclusive influence. Even in situations where schooling at a local site is affected by state or federal legislation, long-range decisions of how best to comply with state or federal regulations place principals (or management teams) in the role of forming policy. Hall et al. (1985, p.8) describes an educational system as an organization where resources are converted into educational services for pupils. From their perspective, public education is a nested set of educational systems that exists at the levels of classroom, school, district, or state, each with varying responsibility for governance.

Rationales for what an indicator system should do are constructed around needs-to-be-met that are as pressing at the local site as they are at state and federal levels. For example, McDonnell (1987), in discussing the needs of policymakers versus researchers, maintains that researchers want a model with indicators that have theoretical relevance and causal impact. Indicators should help researchers to identify factors in education and how they interrelate to produce effects. The policy community, however, is more concerned about indicators that identify factors they can influence--factors that appear to be present when the direction of a valued outcome is consistently altered. The specific interrelationships among these factors as they produce effects is less important than the consistency with which effects are produced when all are present.

School sites also have a stake in knowing more about dependable associations that exist between conditions of schooling and desired outcomes. School-site managers are as involved as executives at more inclusive levels of education in making decisions having an impact intended to be long term. In one way or another, these decisions are conscious attempts to deal with resources and how they are to be used; delivery of services to diverse subpopulations of students; standards for what will be taught, who will teach, and what students will be eligible to participate; goals in achievement that will be pursued; and outcomes that will be accepted.

Shavelson et al. (1987) identify five¹¹ functions that an indicator system might serve in the *policy context* of a national system of indicators. Four of them are equally relevant to management and policymaking at school sites:

- Describing status, such as level of participation in science or mathematics by ethnicity, gender, and social class;
- Providing an early warning by identifying emerging trends and problems, such as sharp declines in achievement by certain subpopulations;
- Identifying policies that appear to be succeeding or unintended consequences of policies that have been put into effect; and
- Supporting leadership in school reform, such as information that shows to what extent students are engaged in "hands on" science.

Local policymaking needs the same kind of data-driven enhancements as federal policymaking. Local principals and management teams may not be pressing for education indicators with the same intensity as state and federal policymakers, but their collective silence may have little to do with a lack of capacity to make an association between indicator data and long-term decisions. More likely, site managers have not made an issue of having better indicators because:

- School sites have never had much data that pertained specifically to the site;
- Data that have been available deal mainly with scores on standardized achievement tests that are not linked very closely to other factors, such as background characteristics of students, qualifications of teachers, and what teachers teach; and
- Generation of data has seldom been under site control. Local sites tend to be given data rather than a capacity to generate data. In other words, they receive data that have been packaged for them. Furthermore, the cycle in which data are provided may not match the cycle in which site decisions are made.

Looking to the Future

As previously mentioned, comparison of NAEP achievement data across states will begin in 1991 with grade 8 mathematics performance. As was the problem with the U.S. Department of Education's "Wall Chart," NAEP achievement data are hard to disaggregate in ways that show fair comparisons across states. The use of "co-statistics," along with the NAEP achievement data, has been proposed

¹¹The five functions are: describing national status, describing state status, early warning, informing policy and practice, and providing leadership.

by the Department of Education as a way of adjusting NAEP differences to make them more "fair". However, there is little evidence that the variables proposed as "co-statistics" are related to states' average achievement. These include (among others) per capita income, length of school year, use of competency tests, average teacher salary, and per pupil expenditure. According to Koretz (1991), adjusting for differences in state-level median income will not make NAEP comparisons fair if, for example, differences in state-level median income represent irrelevant differences in the cost of living.

Legislation currently prohibits use of NAEP to compare schools or districts, but efforts are under way to introduce new legislation to allow this. The original monitoring function of NAEP has been supplanted in recent years with accountability and explanatory functions, thus the resultant movement toward district-level NAEP. At the same time, several national groups, including the National Education Goals Panel and consortia of researchers and practitioners, are advocating a new national (or regional) test which is given to all students and used for accountability purposes. Much support, especially at the presidential level, has been generated for this idea.

National efforts to develop and collect indicator data may not currently be able to provide much indicator information to local districts or schools, but there are ways in which the wealth is accumulating from this work can be distributed to local districts. First, the NCES operates an annual national survey, the Common Core of Data (CCD), which includes both fiscal and nonfiscal data. The survey collects data at the school, district and state level, but generally reports data only at the district level or higher. Since 1988, a report released annually describes the characteristics of the 100 largest public elementary and secondary school districts in the United States, including such data as enrollments, number of graduating students, number with Individualized Educational Plans (IEP), and pupil-teacher ratios. Recent improvements in the CCD database, including agreement among states on common definitions and methods, have enabled a more comprehensive look at the nation's and states' breadth and quality of schooling. In conjunction with the CCSSO, NCES and its national Forum group have focused in recent years on developing a comprehensive, accurate, and timely reporting system for delivery to states.

In a joint NCES-Census-CCSSO project, the 1990 Census mapping currently is being carried out, converting census blocks to the nation's 17,000 school districts. School district boundaries are being superimposed on a census map by block and the information digitized and converted to Census TIGER files. State coordinators assist in the mapping. More than 200 tabulations covering demographic characteristics will be run at the school district level and distributed free to districts in 1992, along with a CD-ROM disc and user-friendly software. The CD-ROM file will include data from the 1990 Census, along with the NCES CCD ID# to allow merging of CCD data with Census data. Variables include a large range of demographic population data, fiscal characteristics, as well as education context variables, such as dropouts and percentages of free lunches. It is likely that state level and district-level outcome data also can be added to the database to allow analysis of relationships.

As methodological and data collection problems are solved at the federal level, local districts can benefit by using those solutions to develop their own information. Many of the problems being addressed nationally in the design of data collections are similar to problems that local sites face on a smaller scale. For example, much of the effort in national projects goes into the design of data collection so that information about student outcomes can be disaggregated by ethnicity and gender and by other variables that represent school background characteristics, school resources, and school processes. Local sites need to be able to see many of the same kinds of disaggregations if they are to do well in making good policy.

New knowledge about indicators being generated at the federal level that also can benefit local sites relates to research recommended to collect indicator data about context and process variables such as "what is taught" and students' "opportunity to learn." This kind of research needs to be done in collaboration with teachers and administrators at local sites.

Involvement of local administrators and teachers in different aspects of design and interpretation of data has two potential benefits. First, there is a beginning of an investment in the most basic units of an infrastructure--local sites--for generating information about education. Sites that work collaboratively with national research projects on developing new indicators will become models for how local school sites can generate quality information about context and processes. Second, the methods and technology that grow out of these projects may be more feasible for local sites to carry out than for the staff of a nationwide project. Local sites do not assess costs in the same way as national projects. What is a true cost of data collection for a national project may be more like staff development and collaborative planning when the data collection is "owned" by site-level staff. Agencies who sponsor or conduct research on new such indicators should consider ways to disseminate findings to local sites, even before some of the findings can be incorporated into data collection efforts to support a national system.

Some of the problems associated with developing a national indicator system are not relevant to the problems that school sites would have in generating indicator data. Problems of gaining cooperation by states, districts and schools also are not relevant.

Of particular relevance to local sites are problems such as the following:

- Level of detail of survey questions needed to get at different aspects of an indicator variable;
- Considerations about consistency in data collection from one year to the next that will improve the comparability of indicator statistics over time. In particular, what kinds of problems need to be anticipated in maintaining a sample across years?
- Methods used to obtain different kinds of information that are critical knowledge for local sites if indicators generated are to be meaningfully compared to national standards;

- Agreement on common definitions of important terms such as dropout; and
- Integration of data from various sources.

Although federal developments may eventually enable states and districts to either obtain relevant data or to develop their own indicator system, administrator training and staff development in this field is not a federal responsibility. Although it is becoming increasingly possible to envision a comprehensive database in operation in perhaps 90% of school districts and in many school sites by the year 2000, state agencies probably will need to be trained by federal-level representatives in use of such a database. In turn, state trainers could train staff at the district level, and school personnel could be trained by district staff. A state commitment to bringing the capacity to monitor changes over time and disaggregate to important constituencies would be necessary.

There is an important need to ascertain the capacity of sites to generate indicator data to support their own management. First, although most school administrators have access to powerful computer hardware and software applications (such as d-base and Excel), many use computers primarily for word processing. Easy-to-use technology for data management already is in place, and the investment in training needed to take significant advantage of the available technology is fairly modest. Few local school sites are likely to be staffed in ways that would support on-site generation of indicators. However, the current lack of staffing is likely to have more to do with how the tasks of school management have evolved and how time is allocated than it has to do with lack of interest or talent. As schools across the country continue a process of restructuring, the locus of responsibility for school management and policymaking shifts closer to school sites. The roles of principals and teachers no longer fit more classic roles of management and labor. Increased responsibility for school site management brings increased opportunities for different kinds of staffing. The fact that school sites have not engaged in serious efforts to generate data and maintain databases in support of policymaking should not that they will not develop this kind of capacity in the future. The times are changing.

References

- Blank, R. (December 1986). *Science and mathematics indicators: Conceptual framework for a state-based network*. Washington, D.C.: Council of Chief State School Officers.
- Blank R., & Dalkilic, M. (1990). *State indicators of science and mathematics education*. Washington, D.C.: Council of Chief State School Officers.
- Bottani, N. (1991, April). *The task of identifying international educational indicators*. Paper presented at the annual meeting of the American Education Research Association, Chicago.
- Burstein, L. (1988). Educational quality indicators in the United States: Latest developments. *Studies in Educational Evaluation*, 14, 75-89.
- Burstein, L. (1991). *Special study panel on education indicators*. Paper presented at the conference of the National Center for Research on Evaluation, Standards, and Student Testing, Manhattan Beach, CA.
- Burstein, L., Baker, E., Aschbacher, P., & Keesling, W. (November, 1985). *Using state test data for national indicators of education quality: A feasibility study*. Los Angeles: University of California, Center for the Study of Evaluation.
- Dimensions: State testing programs and purposes. (1991, April 10). *Education Week*, p. 7.
- Hall, G., Jaeger, C., Kearney, C. P., & Wiley, D. (1985). *Alternatives for a national data system on elementary and secondary education*. Washington, D.C.: U.S. Department of Education.
- McDonnell, L. (1989). The policy context. In R. Shavelson, L. McDonnell, & J. Oakes (Eds.), *Indicators for monitoring mathematics and science education: A sourcebook*. Santa Monica, CA: The RAND Corporation.
- McDonnell, L., Burstein, L., Ormseth, T., Catterall, J., & Moody, D. (1990). *Discovering what schools really teach: Designing improved coursework indicators*. Santa Monica, CA: The RAND Corporation.
- Murnane, R., & Raizen, S. (1988). Improving indicators of the quality of science and mathematics education in grades K-12. Washington, D.C.: National Academy Press.
- National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington, D.C.: U.S. Government Printing Office.
- National Education Goals Panel. (1991, March). *Measuring progress toward the national education goals: Potential indicators and measurement strategies*.
- National Forum on Education Statistics. (1990). *A guide to improving the national education data system: Executive summary*. Washington D.C.: The National Education Statistics Agenda Committee.
- National Science Board Commission on Precollege Education in Mathematics, Science and Technology. (1983). *Educating Americans for the 21st century*. Washington, D.C.: National Science Foundation.

- Oakes, J. (1986). *Educational indicators: A guide for policymakers*. New Brunswick, NJ: Center for Policy Research in Education, Rutgers University.
- Office of Educational Research and Improvement State Accountability Study Group. (September 1988). *Creating responsible and responsive accountability systems*. Washington, D.C.: U.S. Department of Education.
- Porter, A. (1991). Creating a system of school process indicators. *Educational Evaluation and Policy Analysis*, 13(1), 13-29.
- Raizen, S., & Jones, L. (Eds.). (1985). *Indicators of precollege education in science and mathematics: A preliminary review*. Washington, D.C.: National Academy Press.
- Romberg, T. (1987). A causal model to monitor changes in school mathematics. In T. Romberg & D. Stewart (Eds.), *The monitoring of school mathematics: Background papers*. Madison: Wisconsin Center for Education Research.
- Romberg, T., & Smith, M. (1987). The monitoring of school mathematics. In T. Romberg & D. Stewart (Eds.), *The monitoring of school mathematics: Background papers*. Madison: Wisconsin Center for Education Research.
- Romberg, T., & Stewart, D. (Eds.). (1987, March). *The monitoring of school mathematics: Background papers*. Madison WI: Wisconsin Center for Education Research.
- Selden, R. (1988, March). Missing data: A progress report from the states. *Phi Delta Kappan*, 69(7), 492-494.
- Shavelson, R., McDonnell, L., & Oakes, J. (Eds.). (1989). *Indicators for monitoring mathematics and science education: A sourcebook*. Santa Monica, CA: The RAND Corporation.
- Shavelson, R., McDonnell, L., Oakes, J., Carey, N., & Picus, L. (1987). *Indicator systems for monitoring mathematics and science education*. Santa Monica, CA: The RAND Corporation.
- Shavelson, R., Oakes, J., & Carey, N. (1987). A conceptual indicator model of changes in school mathematics. In T. Romberg, & D. Stewart (Eds.), *The monitoring of school mathematics: Background papers*. Madison: Wisconsin Center for Education Research.
- Task Force on Education for Economic Growth. (1983). *Action for excellence: A comprehensive plan to improve our nation's schools*. Washington, D.C.: Education Commission of the States.
- Twentieth Century Fund Task Force. (1983). *Report of the Twentieth Century Fund Task Force on Federal Elementary and Secondary Education Policy*. New York: The Twentieth Century Fund.
- U.S. Department of Education. (1984). *State education statistics*. Washington, D.C.: Office of Planning, Budget, and Evaluation, Planning and Evaluation Service.
- With goals in place, focus shifts of setting strategy. (1990, March 7). *Education Week*, p. 1.